described herein, various embodiments of the present invention operate in such an environment by first determining, for all (or some) of the known fields, which demodulation type should be used. Also, if information about known fields for the interferer is available, or can be estimated, a determination of which demodulation type to be used may be made for these interferer locations. To do this, the following steps may generally be performed.

1. The quantities for determining whether to use a single-user demodulation approach or an approach that performs interference cancellation can be estimated at each known sequence of desired signal. These can include similar estimates as those described in United States Patent Application No. 09/464,830, entitled "Selective Joint Demodulation Systems and Methods for Receiving a Signal in the Presence of Noise and Interference," filed December 19, 1999, which is hereby incorporated herein by reference in its entirety. Such estimates can include desired signal carrier power (C), noise power (N), carrier to interference plus noise ratio (C/(I+N)), interference to noise ratio (I/N) or other ratio calculated based on ones of C, N, I or received signal power. It can also include the noise covariance matrix across multiple antennas.

2. Decide, at each known signal field/block, which demodulation type, conventional (single user) or interference cancellation, to use for the adjacent unknown symbol field/block.

3. Detect the interferer slot boundary, and if it is detected, estimate its location and the location of any interferer known fields.

4. If any interferer known fields are located, estimate interferer quantities and again determine which demodulation type to be used based upon this additional information.

Once a determination is made regarding which demodulation type to use for each unknown field/block, the demodulation direction may be determined for each unknown field. Possible approaches for this include:

1. Use bi-directional demodulation over each unknown field/block, choosing the forward demodulation type from the decision at the left known field and the backward demodulation type from the decision at the right known field. The demodulation may proceed from each end until all of the data is demodulated. If there is a detected interferer boundary in the unknown field, demodulation from each side

may proceed until this boundary is reached, otherwise each demodulation may proceed until they reach in the middle of the unknown field.

2. For unknown fields where the interferer boundary is detected, operations may proceed as above. For those unknown fields where no interferer slot boundary is detected, a decision may be made as to which known field has the better channel quality estimate. The demodulation then may start from this known field using the selected demodulation type.

However, as will be discussed below, there may only be one known field within the slot to be demodulated (as is typically the case for the IS-136 uplink). A multi-pass demodulation technique, such as discussed by Fulghum in United States Patent Application Serial Number 09/201,623, may then be used. In this approach a first demodulation pass can be used together with channel decoding and subsequent re-encoding and re-modulation to identify known symbol locations within the desired signal slot. The sequences of these assumed known symbols can then be used in various embodiments of the present invention. In various embodiments, the following operations may be provided:

1. The interferer slot boundary may provide differentiation between where conventional demodulation and interference cancellation should be used, and the slot can be divided into two to use the desired demodulation on each side. The assumed known symbols may provide channel estimates for the unknown symbol locations of the desired signal using interpolation.

2. As the accuracy of the desired signal's channel estimate may be subject to the interference, it may be preferred to track the desired signal channel even though the known or pilot symbols are available. In this case, the slot can be subdivided into regions (or subfields), where each region may contain one or more pilot symbols. Each region may serve in a similar manner as a sequence of known symbols to be used in the bi-directional approach generally described above. The pilot symbols can be used to generate initial channel estimates for demodulating each region.

Various embodiments of the present invention will now be further described for the case where there is a discontinuous interferer located within the extent of the desired signal slot. However, the present invention may be applied where there are interferers with multiple discontinuities within an interferer slot and the present

invention may be readily extended to cover these cases in light of the present disclosure.

Referring now to **Figure 2**, a received signal having two desired signal known fields/blocks **210, 215** and an unknown field/block **220** within the desired signal (D) is shown. This would be applicable, for example, to the IS-136 downlink when training sequences are available for the desired user's slot and the following user's slot. A slot misaligned interferer (I) signal **230** is also shown. The interferer slot boundary may be detected between the two known fields of the desired signal and, for example, conventional demodulation (CD) may be used starting from the left known field and joint demodulation (JD) may be used starting from the right known field. Operations related to determining the demodulation approach for various embodiments are further described with reference to the flowchart illustrations of **Figures 6** and **8**.

Referring now to **Figure 3**, a received signal having a single desired signal known field/block **305** within the desired signal (D) is shown. This may occur in the case where there is only a single known field for the desired signal (such may be the case, for example, in the IS-136 uplink or for GSM systems). Alternatively, this may occur at the edges of the slot even if there are many known fields present. A slot misaligned interferer signal (I) **310** is also shown. For each unknown data field that is adjacent to only one known field of the desired signal, if an interferer boundary is detected over the unknown data, the demodulation type in use can be converted from one demodulation type to the other under consideration. For example, as shown in **Figure 3**, joint demodulation (JD) is chosen over known Field 1 **305**. When demodulating to the left of this known field **305**, an interferer boundary is detected and the demodulation type can be switched from joint demodulation to conventional single user demodulation (CD). Note, that there may be cases where there is a boundary between two adjacent interferer slots, but in the absence of having a known field/block to make a decision about which demodulation technique to use, the fall-back may be to use conventional demodulation. Operations related to the environment shown in **Figure 3** are further described with reference to the flowchart illustrations of **Figures 7** and **8**.

Figure 4 is a schematic block diagram illustrating receiver systems for processing a received signal in accordance with various embodiments of the present invention. As shown for the embodiments in **Figure 4**, the system **400** includes a